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insertion section. The insertion section comprises a forearm, a wrist and an end effector. The end effector is a modified surgical instrument such as retractors, electrosurgical cutters, electrosurgical coagulators, forceps, needle holders, scissors, blades and irrigators. The control section contains motors and linkages which operate the insertion section with five or more degrees of freedom. The control section inserts, retracts, pivots and rotates the forearm with four degrees of freedom about axes that all intersect adjacent a small incision through which the insertion section is introduced to the patient. The control section also pivots the wrist with at least one degree of freedom relative to the forearm and operates the end effector. The surgical manipulator provides superior flexibility in performing endoscopic procedures compared to standard rigid endoscopic instruments and is adapted for teleoperator control.--

IN THE CLAIMS:

Delete claims 1-25 in the application as originally filed.
Add the following new claims 26-46:

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26. An endoscopic surgical instrument comprising a control section and an insertion section wherein:

the insertion section is adapted to be inserted into a patient through a small incision to a location adjacent a worksite in the patient;

the insertion section comprises a forearm link, a wrist link and an end effector wherein:

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the forearm link has a proximal end, a distal end and a forearm axis extending longitudinally from the proximal end of the forearm to the distal end of the forearm;
the wrist link has a proximal end and a distal end and a wrist axis extending from the proximal end of the forearm to the distal end of the forearm;
the proximal end of the forearm link is connected to the control section, the distal end of the forearm link is connected to a pivotal wrist joint; and

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the proximal end of the wrist link is connected to the pivotal wrist joint and the distal end of the wrist link is connected to the end effector;
and the control section comprises a plurality of control motors and linkages adapted to operate the insertion section with at least five degrees of freedom including:

insertion and retraction of the forearm link along the forearm axis and through the small incision;
rotation of the forearm link about the forearm axis;
pivotal motion of the forearm link about a first pivotal axis and a second pivotal axis which are perpendicular to each other and intersect the forearm axis at a pivot point adjacent the small incision; and
pivotal motion of the wrist link relative to forearm link.

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27. The endoscopic surgical instrument as described in claim 26 wherein the wrist link comprises an inner link and an outer link and wherein the control section is adapted to operate the insertion section with at least six degrees of freedom including movement of the outer link of the wrist link relative to the inner link of the wrist link.

28. The endoscopic surgical instrument as described in claim 27 wherein the outer link of the wrist link and the inner link of the wrist link are axially aligned and wherein the control section is adapted to rotate the outer link relative to the inner link.

29. The endoscopic surgical instrument as described in claim 26 wherein the end effector comprises a first element and a second element and wherein the control section is further adapted to move the first element relative to the second element.

30. The endoscopic surgical instrument as described in claim 27 wherein the end effector comprises a first element and a

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second element and wherein the control section is further adapted to move the first element relative to the second element.

31. The endoscopic surgical instrument as described in claim 26 wherein end effector comprises a surgical instrument head selected from the group of retractors, electrosurgical cutters, electrosurgical coagulators, forceps, needle holders, scissors, blades and irrigators.

32. The endoscopic surgical instrument as described in claim 26 wherein the control section is adapted to be fixed to a support rail of a surgical table for support of the surgical manipulator during surgery.

33. A surgical method for endoscopic surgery comprising the steps of:

providing an endoscopic surgical instrument comprising a control section and an insertion section wherein:

the insertion section is adapted to be inserted into a patient through a small incision to a location adjacent a worksite inside the patient;

the insertion section comprises a forearm link, a wrist link and an end effector wherein:

the forearm link has a proximal end, a distal end and a forearm axis extending longitudinally from the proximal end of the forearm to the distal end of the forearm;

the wrist link has a proximal end and a distal end and a wrist axis extending from the proximal end of the forearm to the distal end of the forearm;

the proximal end of the forearm link is connected to the control section, the distal end of the forearm link is connected to a pivotal wrist joint; and

the proximal end of the wrist link is connected to the pivotal wrist joint and the distal end of the wrist joint is connected to the end effector;

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inserting the forearm link along the forearm axis through the small incision;
operating a servomechanism to rotate the forearm link about the forearm axis;
operating a servomechanism to pivot the forearm link about a first pivotal axis and a second pivotal axis which are perpendicular to each other and intersect the forearm axis at a pivot point adjacent the small incision;
operating a servomechanism to pivot the wrist link relative to the forearm;
manipulating human tissue with the end effector at the worksite inside the patient;
and operating a servomechanism to retract the forearm link along the forearm axis through the small incision.

34. The method as described in claim 33 wherein:
the step of providing a surgical manipulator comprises providing a surgical manipulator with a wrist link which comprises an inner link and an outer link; and
the method comprises the additional step of operating a servomechanism to move the outer link of the wrist link relative to the inner link of the wrist link.

35. The method as described in claim 34 wherein:
the step of providing a surgical manipulator comprises providing a surgical manipulator wherein the outer link of the wrist link and the inner link of the wrist link are axially aligned; and
the step of moving the outer link of the wrist link relative to the inner link of the wrist link comprises the step of operating a servomechanism to rotate the outer link relative to the inner link.

36. The method as described in claim 33 wherein:
the step of providing a surgical manipulator comprises
providing a surgical manipulator wherein the end effector
comprises a surgical instrument having a first element and a
second element; and
the method comprises the additional step of operating a
servomechanism to move the first element relative to the
second element.

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37. The method as described in claim 34 wherein:
the step of providing a surgical manipulator comprises
providing a surgical manipulator wherein the end effector
comprises a surgical instrument having a first element and a
second element; and
the method comprises the additional step of operating a
servomechanism to move the first element relative to the
second element.

38. The surgical method as described in claim 33 wherein:
the step of providing a surgical manipulator comprises
providing a surgical manipulator wherein the end effector
comprises a surgical instrument head selected from the group
of retractors, electrosurgical cutters, electrosurgical
coagulators, forceps, needle holders, scissors, blades and
irrigators; and
the step of manipulating human tissue comprises the step of
actuating the surgical instrument head.

39. The surgical method as described in claim 33 further
comprising the step of mounting the control section on a support
rail of a surgical table for support of the surgical manipulator
during surgery.

40. An endoscopic surgical instrument comprising an
insertion section and a control section wherein:

the insertion section is adapted to be inserted into a patient through a small incision to a location adjacent a worksite in the patient;
the insertion section comprises a forearm link, a wrist link and an end effector wherein:

the forearm link has a proximal end, a distal end and a forearm axis extending longitudinally from the proximal end of the forearm to the distal end of the forearm;
the wrist link has a proximal end and a distal end and a wrist axis extending from the proximal end of the forearm to the distal end of the forearm;
the proximal end of the forearm link is connected to the control section, the distal end of the forearm link is connected to a pivotal wrist joint; and
the proximal end of the wrist link is connected to the pivotal wrist joint and the distal end of the wrist joint is connected to the end effector;

and the control section comprises:

means for inserting and retracting the forearm link along the forearm axis and through the small incision;
means for rotating the forearm link about the forearm axis;
means for pivoting the forearm link about a first pivotal axis and a second pivotal axis which are perpendicular to each other and intersect the forearm axis at a pivot point adjacent the small incision; and
means for pivoting the wrist link relative to the so as to control the angle between the forearm axis and the wrist axis.

41. The surgical manipulator as described in claim 40 wherein the wrist link comprises an inner link and an outer link and wherein the control section further comprises means for moving the outer link of the wrist link relative to the inner link of the wrist link.

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